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(The Organ of the Mysore Agricultural and Experimental Union)

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IN THIS ISSUE

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METEOROLOGICAL OBSERVATIONS APPLIED TO AGRICULTURE

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SOME INDIGENOUS STRUCTURES USED FOR GRAIN STORAGE IN RURAL PARTS OF MYSORE

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The harvested grain has to be protected from deterioration and damage by insects, rodents and moisture. It should also retain its germinating power when required for use as seed. Due to variation in rainfall and temperature of the areas, there is difference in storages which are in vogue in Maidan and in Malnad parts. Recently a survey of the indigenous storage structures was taken up in representative Taluks of Anekal and Magadi in Bangalore District, Jagalur in Chitaldrug District and Mudigere in Chickmagalur District. The following main types of storages are found to be in common use :

Vadais (ವಾಡೆ), which are indoor and above ground storage structures, are commonly used by householders to store foodgrains in small quantities. These are earthen vessels with the shape resembling the shape of the ellipse with flattened and open ends (Fig. 1). The opening at each end measures about 1′ and 2″ in diameter. It is usually made in two or three parts which can easily be jointed at spot with clay placing one above the other. Being in parts, the container is also easy for transport from place to place. It is placed on a stone slab to prevent the grain from absorbing moisture. The points of juncture round the rim of the bottom are plastered with either clay or with cowdung. The parts of *vadai* are also jointed and plastered. It is then filled up with grains through the opening at the top (mouth). The mouth is covered by putting either a circular stone slab or earthen plate. The grain is removed through the opening at the top of the container till about half and then the upper portion of the *vadai* is removed so that all the stored grain can be taken out without any difficulty.

The shape and the size of *vadai* vary considerably (Figs. 1 to 3). Usually it is of the shape which has been shown in Sketch 1. It measures 4′ 4″ in height and 9′ 2″ in circumference at the widest region. It can accommodate 320 seers of ragi and the cost of this is learnt to be Rs. 15.

Sometimes, as in Jagalur Taluk, the *vadais* are fixed in walls. In such case the *vadai* has no opening at the bottom and also it is made of only one piece. It has a circular opening about 1′ above from the bottom on a side to facilitate to draw the grain from the container (Fig. 5). On the top in the wall there is opening like a trap door

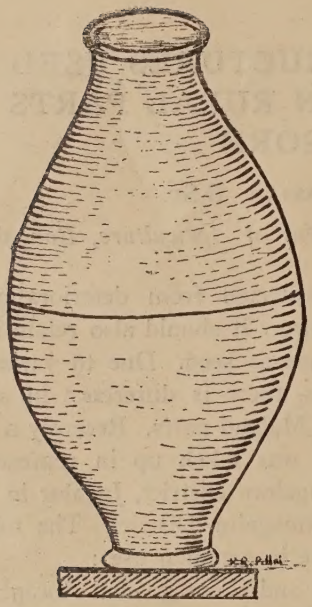

FIG. 1

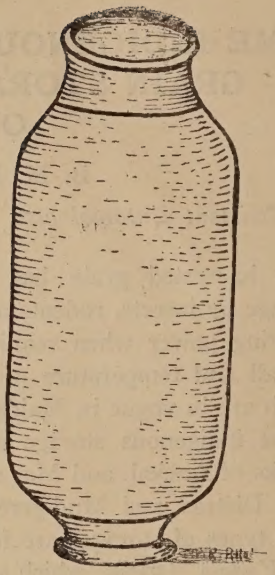

FIG. 2

FIG. 1. *Vadai*, made in two pieces, of burnt clay, on a stone slab common in Maidan parts.

FIG. 2. *Vadai*, made in one piece, of burnt clay.

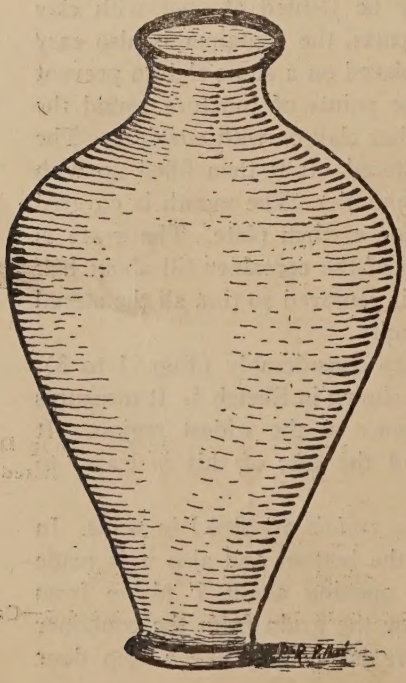

FIG. 3

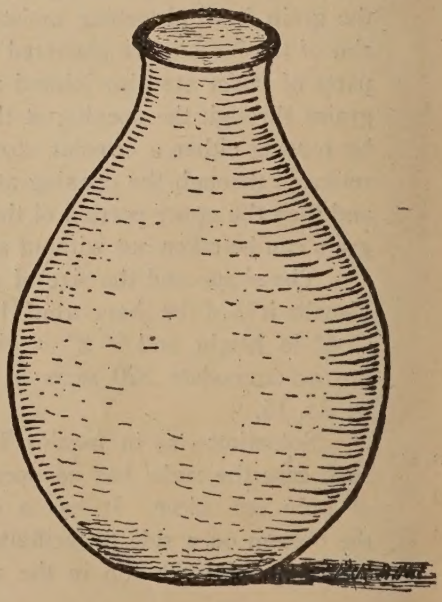

FIG. 4

FIG. 3. *Vadai*, made of burnt clay.

FIG. 4. *Kalasige*, made of burnt clay, common in Bangalore District.

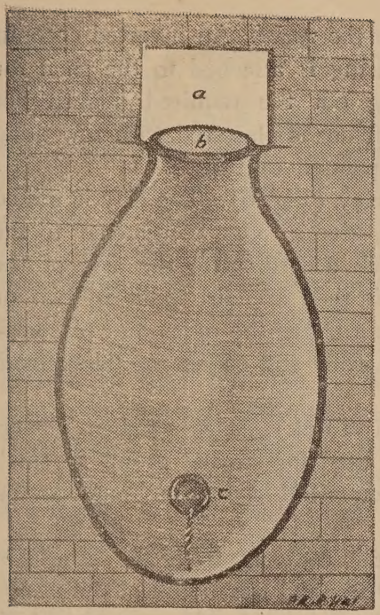

FIG. 5

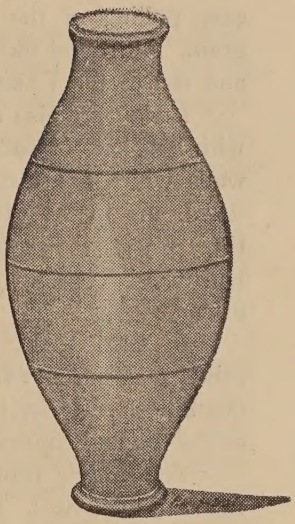

FIG. 6

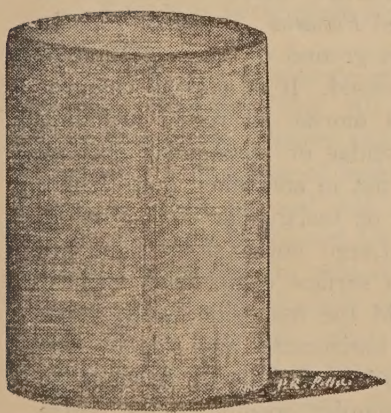

FIG. 7

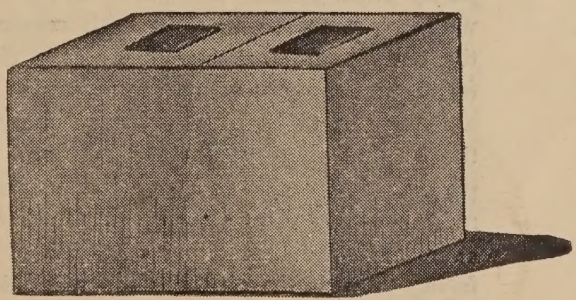

FIG. 8

FIG. 5. *Vadai*, made in one piece, of burnt clay, fixed in a wall—Common in Chitaldrug District. *a*. Trap-door in the wall; *b*. Opening of the *Vadai*; *c*. Hole for taking out the stored grain. It is closed by means of a coconut shell tied to a string.

FIG. 6. *Vadai*, made in four pieces, of unburnt clay—Common in Bangalore District.

FIG. 7. 'Bamboo bin', made of bamboo mat—Common in both Malnad and Maidan parts.

FIG. 8. *Kanaja* or *Panatha*, underground storage structure with two openings at the top—Common in Maidan parts.

through which the grain is poured into the *vadai*. An inverted coconut shell is fixed to the opening and a string is attached to the shell for easy pulling of the shell after taking out the required quantity of grain. All round the shell the space left out is plastered with cow dung and red earth. *Chunam* will also be painted over it.

Vadais are also made of unburnt clay (Fig. 6). The clay is mixed with long bits of paddy straw so as to give a tough consistency to the walls which are about 1 to 1½" thick according to the size of the *vadai*. As in the case of burnt *vadais* they are also built in two or three pieces, the pieces being placed one above the other and plastered with clay. These are not fixed in the walls and cannot be taken from place to place.

In Chakrabhavi village (Magadi Taluk), large earthen vessels called *Kalasige* "ಕಳಸಿಗೆ" (Fig. 4) are used for storing grains in small quantities. *Kalasige* is a common earthen vessel having only one opening at the top and convex bottom.

The *vadais* completely prevent the contents from the attack of rats and dampness. The joints, the bottom and the mouth of the *vadais* are their weak points and cannot be made proof against insects which frequently occur in the grains stored in them.

Another type of indoor storage structure which is common in Maidan parts is *Kanaja*. It is also called *Panatha* (ಪಣತ) or *Palatha* "ಪಳತ" (Fig. 8). It may be either under-ground or above-ground or partly under-ground and partly above-ground. It is a stone chamber with the burnt stone slabs with cement mortar all round including the bottom and the top. There is a circular or rectangular opening on the top through which grains can be put in and taken out. Where a *Kanaja* is to be constructed a square or rectangular pit is dug in the ground to a required dimension. Large burnt stone slabs are placed side by side to cover the bottom surface completely. Cement mortar is placed at the joints. To build the four side walls, burnt stone slabs are kept either vertically or horizontally and side by side facing towards the pit. The top will also be covered with burnt stone slabs leaving either a circular or a rectangular opening at the centre through which a man can pass while taking out the grain from the storage.

Before filling the *kanaja* with ragi (*Elusine coracana*), a layer of ragi husk to the thickness of 2½ to 3" is put on the bottom surface. It is then filled with ragi and the opening at the top is closed with a burnt stone slab or wooden plank. The capacity of these *kanajas* vary considerably. *Kanaja* which measures 5' breadth, 6' 6" length and 5' 4" depth will accommodate 3,500 seers of ragi. To strengthen the sides sometimes brick and mortar or mud wall is built along the outer sides of the chamber. The cost of construction of these *kanajas* is heavy.

To construct a *kanaja* which can accommodate 3,500 seers of ragi it costs about Rs. 88.

In Jagalur Taluk *kanaja* or *palatha* is usually constructed in dwelling house preferably in *varandas*. A room is selected and the ground is dug about 3′ deep. The flooring is then levelled and thumped. A layer of mortar is then plastered to form an even surface. The side walls are also plastered with the mixture of sand and red earth and levelled up. The top is covered by means of slabs of stones leaving in the centre on the top an opening which measures about 1½′ square. An wooden plank is used to cover the opening after the *palatha* is filled with the grain and the crevices round the wooden plank are plastered with cow dung and mud. Sometimes if the *palatha* is too long a wall of about 9″ thickness will be constructed in the centre and thus two compartments with two separate openings at the top are made. In such case grains of different kinds can be stored separately side by side. To get into the *palatha* and to take out the grain a ladder is used. The grain can be retained in *palatha* over a period of two years. Once when it is emptied all the inner surfaces are painted with cow dung before refilling it with grains. These *palathas* are not being used for preservation of *jola* (*Andropogon sorghum*).

Kanaja is fairly good proof against rat and insect attack and also dampness.

Third type of storage structure which is used only in Maidan is *Hagevu* "ಹಗೇವು" (Fig. 10). It is an under-ground and out-door storage structure. Shapes and sizes of *hagevus* greatly vary. A common *hagevu* is a flask-shaped hollow underground pit with a narrow round opening at the top and with a flattened bottom. A place where there is no dampness is selected for constructing the *hagevu*. A high ground where the level of the subsoil water is low is preferred. A circular pit measuring 1½′ in diameter is dug at the commencement to the depth of 2½′. A man will rather uncomfortably sit in this pit and will go on scooping the soil at the same time widening the bottom of the pit. The depth of the *hagevu* measures 7′ from ground surface with the diameter of the circular opening 1½′ and broadest region of the pit is 6′. This can accommodate about 2,000 seers of ragi. A layer of ragi husk to the thickness of 2½ to 3″ is placed at the bottom before filling it with the grains. When the pit is full the mouth is closed with a circular burnt stone slab and plastered with earth level with the surface of the ground. When grain is to be taken out, the mouth of the pit is opened. They will leave it open for sometime before a man can get into it so that the accumulated poisonous gases can pass off. Sometimes they will allow a burning lantern tied to a rope into the pit to test the presence of poisonous gases. In order to empty

it a man goes in to fill a bucket or a basket which is pulled up by means of a rope tied to its ring or to the rim as the case may be.

Where rainfall is too low as in Jagalur Taluk, *pente* (ಪೆಂಟೆ) is used to cover the inner surface of the pit up to the brim before it is filled up with grain (Fig. 9). This *pente* is made out of dried plants of either sajje (*Pennisetum typhoideum*) or jola (*Andropogon sorghum*). After the harvest of the ear-heads of jola or sajje crop the root portion is chopped off and the dried stem portion is used for the structure of the *pente*. 25 to 30 such stem portions are taken at a time and bundled evenly tying them by means of paddy straw which is soaked in water to make it pliable. They will go on adding those stem portions to the length keeping the thickness more or less uniform and tie it to the length of hundreds of feet. A man will get into the pit taking one end of the *pente* and fix it at one point at the bottom side and fix one layer over the other to form a lining on the inner surface of the circular wall up to the brim. A layer of husk of jola or ragi to the thickness of about 4 to 6" will be put and grain will be poured through the opening at the top. A slab of stone is fixed to the opening and the earth is put over it and levelled up to the ground surface.

Storage in *hagevu* is cheap. For constructing an *hagevu* which can hold 2,000 seers of ragi, it is learnt that about 100 seers of ragi are to be spent for coolies as its cost. These *hagevus* are used to store jola in Jagalur Taluk. The defect of *hagevu* system of storage is that the grains absorb moisture and ferment to a small extent. The grains at the bottom and near the walls will be spoilt turning black and becoming unfit for human consumption. When the grain is taken out it feels a little moist and hot and possesses a distinct fermentation smell which disappears to a very great extent when the grain becomes dry. The longer the grain is kept, the greater is the damage. It is estimated that 10 to 15% of the grain is lost in this method of storage after 4 or 5 years.

Bamboo bins (Fig. 7), are also used to store grains in dwelling houses. These are made out of bamboo mat or of the midribs of date-palm leaves. Their walls are plastered with cow dung both inside and outside. They are used for storing paddy, ragi and navane (*Setaria italica*). The capacity of these bins considerably vary. The bin which measures 6' 2" diameter, 4' 7" height and 19' 2" circumference, can accommodate 3,000 seers of paddy. Before filling it with grain, the bin is kept either on a stone slab or on hard ground surface which can prevent rat attack. A layer of ragi or paddy husk to the thickness of 1 to 1½" is put at the bottom in the bin and the grain is poured through the opening at the top. After it is completely filled with grain, ragi or paddy straw or some green leaves are spread on the surface of the

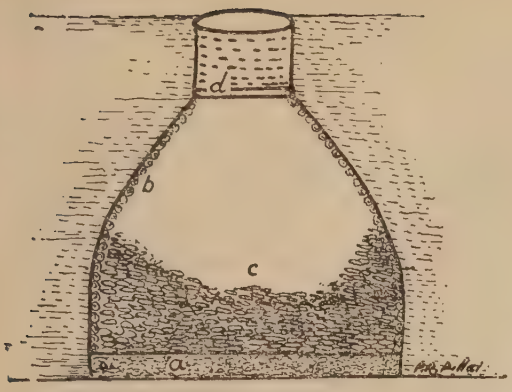

FIG. 9

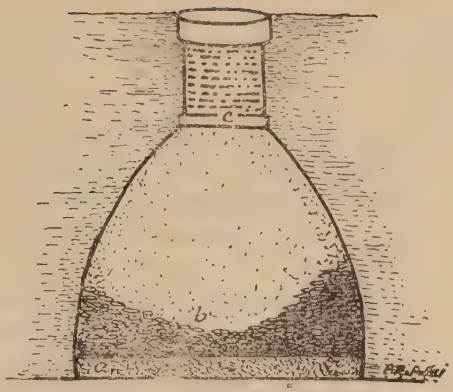

FIG. 10

FIG. 9. *Hagevu*, underground storage pit, common in Chitaldrug District. *a.* Layer of Jola husk: *b.* Lining of pente; *c.* Jola stored in the pit; *d.* A slab of stone to close the opening.

FIG. 10. *Hagevu*, common in Bangalore District. *a.* Layer of Ragi husk; *b.* Ragi stored; *c.* Slab of stone to close the opening.

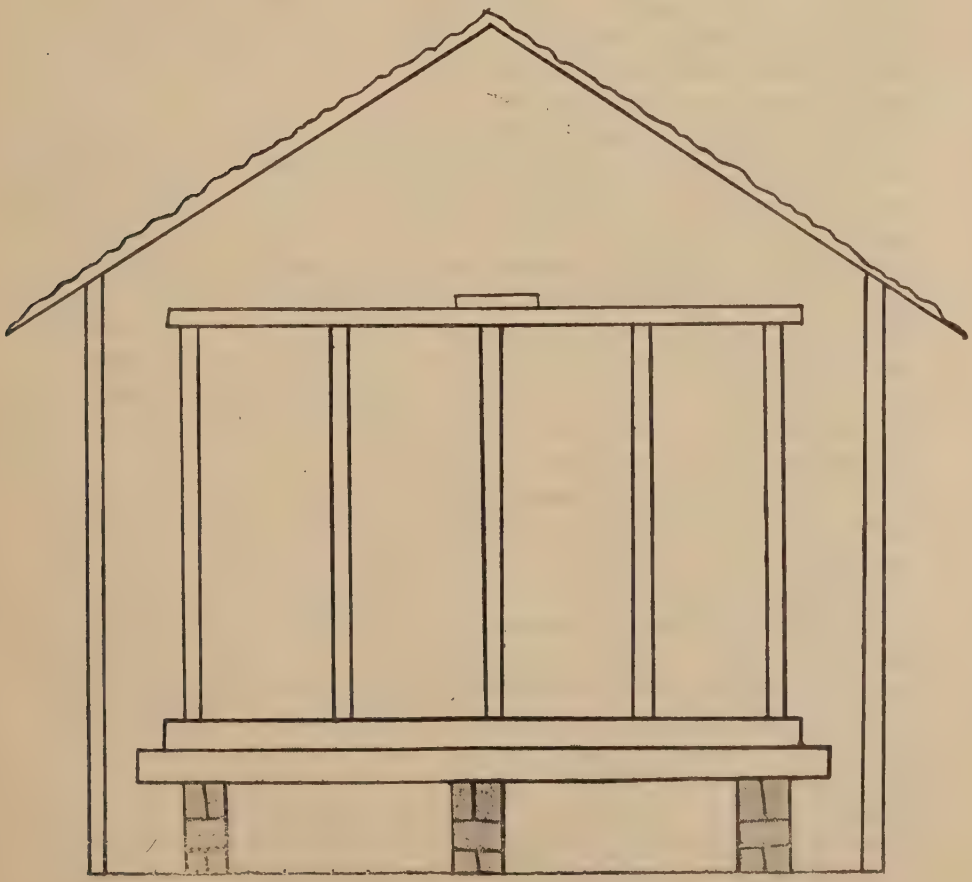

FIG. 11

FIG. 11. *Vaddy*, constructed of wooden planks on a platform in a tiled house, used in Malnad parts for storing paddy.

grain at the top evenly and plastered over with mud and cow dung. Whenever the grain is intended to be taken out the top layer of the mud and cow dung together with the straw or leaves is taken out and the required quantity of grain is removed from the bin. Again it will be closed and plastered with mud and cow dung. In Jagalur Taluk these bins are called *karchis* (ಖರ್ಚಿ).

In Malnad parts underground and out-door storages are never used on account of heavy of annual rainfall. *Kadike* or *thadike* (bamboo bin) and *vaddy* which is also called as *panatha* or *palatha* are in use in Mudigere Taluk in Chikmagalur District for storing paddy.

Kadike or *thadike* (Fig. 7) is a cylindrical bin made of either bamboo mat or *vatebidaru* (ವಾಟೆಬಿದಿರು). The surfaces of mat are plastered with cow dung and red earth. It is then rolled to form a cylindrical bin of required size and stitched. The bin is sometimes kept on an elevated platform to avoid dampness. Before filling it with paddy, a layer of paddy husk or paddy straw to the thickness of 3 or 4" is put on the bottom surface. After it is filled up a layer of paddy straw is put on the top and plastered with mud.

The grain can be stored in this way for one year. After one year, paddy at the bottom will be spoilt on account of moisture. There will be loss of about 100 seers of paddy out of 1,500 seers. In some places they will keep it on a stone slab or on strong foundation to avoid rat attack. After the paddy is removed the bin is removed and the floor is repaired before the bin is placed again. The used layer of paddy husk or the straw at the bottom is thrown out and replaced with the fresh one. It is refilled with the grain after its surfaces are plastered again with cow dung. In Chinnoga (Mudigere Taluk), 15-20 such large bins are being used to store paddy in the dwelling house of Sri. Devappa Gowda, who is a leading *riayat* of the place.

Vaddy system of storage is common in Malnad parts. *Vaddy* (ಪಡ್ಡಿ) is also called as *panatha* or *palatha* (Fig. 11). It is an indoor and over-ground structure which is built under either a thatched or a tiled house to protect it against rain. It is built on a raised platform and it is like *kanaja* built of wooden planks at all sides including bottom and top. It may be either rectangular or square in shape having a rectangular opening with a door on the top at the centre. The capacity of the *vaddies* varies from 6,300 seers to 80,000 seers of paddy. In Banakal village, one Sri. Somegowda, a leading *riayat,* has built a *vaddy* on a platform raised from the ground in order to avoid damp. It measures 40′ in length, 8½′ height and 10½′ width. It has been divided into 5 compartments of equal sizes. The fifth compartment has been again divided into two equal chambers. Each compartment has a wooden door on the top through which paddy can

be put in or taken out of the container. Each compartment from 1 to 4 can take in 14,000 seers of paddy and the capacity of 5th and 6th chambers is 7,000 seers each. All the inner surfaces of the chambers are painted with coal-tar. The grain is put into the chambers through the doors up to the brim. No husk or straw is used on the bottom surface before filling. The door is closed and locked up after each chamber is filled up. To climb up the *vaddy* and to get into it, ladders are used. It is said that there will not be loss even if the paddy is stored more than five years in this system.

I am grateful to Sri. B. Krishnamurti, Government Entomologist, for his kind guidance and encouragement.

DISEASES OF FODDER CROPS IN INDIA

I. Sorghum

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During the long years that followed man's effort to raise crops for his food and fodder purposes he encountered a lot of difficulties of which the most imposing and the important one was disease amongst the plants. His crops were known to get completely spoiled or yield very poor results. Since then it has been an eternal struggle for him to reach to the root of his troubles and from there started the science of plant pathology. Efforts were made to control these diseases and from then it was a regular battle between man and these diseases. During the later years that followed, the scientists were able to establish that most of these diseases were due to the parasitic growth of lower groups of plants, namely, the fungi. After the dawn of bacteriology, some scientists proved that it was not always the fungi that were responsible for the diseases, and that there were also some bacteria which caused these diseases. The later developments that followed in the field of pathological research pointed out to another cause for the diseases, namely, the viruses.

Due to the manifold damages that are being caused to the many important fodder crops in India, a short study on the various diseases encountered in the cultivation of these crops will be highly beneficial from the economic point of view. Of the crops that are solely cultivated for fodder purposes, the regular sorghums and the sorghum grasses, namely, the Sudan and Johnson varieties of grasses form a major part.

The sorghums are cultivated in India both for fodders as well as for food purposes. The physiological anatomy of the plant is almost similar to that of the Indian corn. The susceptibility to the disease and the development of the seed are similar to the above plant. The only major difference is in the development of the inflorescence.

Diseases cause relatively large economic losses in this crop. Seedling blights and the root rots help considerably in reducing the vigor and the healthy growth of this plant. If and when control measures are neglected the losses may exceed several thousands of rupees. There are many types of diseases caused by various agents. The diseases are of various types and of various degrees of virulence. But, however, herein we will confine ourselves to three or four types of diseases caused by various etiological agents, with particular reference to the control methods.

(*a*) *Diseases caused by Micro-organisms, namely, Bacteria*

Bacterial Blights

The most common amongst the bacterial diseases of the sorghum are the bacterial stripe and the streak diseases. The earliest scientist to report this was Burrill (1887-89) who described the sorghum blight and ascribed it to the organism *Bacillus sorghii.* However, in the later years, more scientists worked on this disease and came to other conclusions. Smith, *et al.,* in the years 1905-11 worked on these organisms and they found another causative organism and named it as *Bacterium androphogoni.* This organism which these people isolated was a non-sporiferous, flagellate organism with three flagella at the polar region.

(*i*) *Bacterial stripe*

Causative organism : *Pseudomonas androphogoni* (E. F. Smith).
Phytomonas androphogoni (Bergey, *et al.*).

This disease occurs in almost all the sorghums including the Sudan grass and the Johnson grass. The inoculation of these organisms into sugarcane and corn produce lesions on the surface.

Symptoms.—The lesions appear first as linear stripes on the leaves. These stripes are usually narrow. In many cases these lesions are found to be water-soaked and are banded by the veins of these leaves during the young stages. After sometime the linear stripes fuse together forming a large stripe extending from the leaf sheath to the leaf tip. The colour of the streak usually varies from reddish brown to dark purple. A correspondingly coloured exudate is seen to come off the stripes.

How this organism acts on the cell tissues, and what happens are not yet known exactly. But, however, it is supposed that these organisms secrete enzymes which lead to the dissociation of the cells of the tissues. Some others believe that the cells of the host burst as a result of the pressure exerted by the numerous amount of bacteria.

(*ii*) *Bacterial streak*

Causative organism : *Xanthomonas holcicola* (Elliot).
Phytomonas holcicola (Bergey, *et al.*).

In most cases of the diseases of the sorghums and the grasses, namely, the Sudan and the Johnson varieties growing in the colder regions the bacterial streak seems to be more prevalent than the stripe. This disease causes heavy losses by way of considerable defoliation in the grass and the grain sorghums.

Symptoms.—The first occurrence of narrow streaks ranging from brown to red is the earliest indication of the disease in the crop. Slowly the lesions get water-soaked and irregular oval blotches of colour appear interrupting the continuity of the streak. As the disease advances these oval blotches with dark red margins, inter-mingled with the streak, develop and the lesions coalesce. The lesions usually give out a yellow to cream-coloured exudate.

Control measures.—Control measures for these two diseases seem to be only by the use of resistant varieties of seeds, sanitation and in some cases modification of the cultural practices. Fumigation of the affected portion of the land seem to be of very little value in eradication of these diseases.

(*b*) *Diseases caused by the Fungi*

The fungi also play a very big role in the distribution of diseases of plants. These plants, if they could be called plants in the correct sense, act in the same way as the bacteria and cause great damages in economic value of the yield and the output of the crop. Amongst the fungal diseases the most important is the one commonly known as the Downy Mildew, caused by a species of *Sclerospora.* In our country this fungus works havoc causing a great deal of damage.

(*i*) *Downy Mildew* :

Causative Agent : *Sclerospora sorghii* (Kulk.) var. *Sclerospora graminicola.*

This pathogen attacks all parts of the plant above the ground, namely, the leaves, stem and the fruits. The first appearance of leaf infections is as light yellow appearing areas on the upper side of the leaf either in large or small areas. In case several small areas fuse, the spots may vary from ⅛" to 2" in diameter. Soon the cells of these areas become necrotic and cause a spot of brown dead cells. The conidia and the conidiophores of the fungus develop on the lower surface of the leaf in the form of a white glistening growth. Sometimes if the weather is not favourable the lower surface of the leaf gets covered with the growth of the parasite, in the fruiting stage. On the young stems the first indication of the infection starts as small water-soaked areas. These areas are later on covered with a similar white glistening growth. Leaves of such stems get distorted and dwarfed.

Etiology.—The mycelia of the pathogen penetrates through the intercellular spaces and the haustoria enter the host cells. In many cases the haustoria are vesicular but in others they are branched and filamentous.

The sporangiophores of the fungus are quite different and distinctive from the other fungi. They form divided clusters in the form of

branches and the sporangia on the top. Each sporangiophore of this fungus simulates a thick brush-like growth on the top. The formation of the sporangia start late in the night about the midnight and in about an hour and a half, the sporangia get mature and they are dropped off. The formation of the sporangia continues on the consecutive nights till the climate becomes dry for the formation of sporangia.

Germination of the sporangia on the new host is usually brought about by the formation of zoospores which enter the host cells after the formation of a germ tube which is a characteristic feature of this group of fungi.

Reproduction is also brought about by the formation of antheridia and oogonia. These are formed on the adjacent hyphæ. Each organ is a multinucleate one after separation from the mycelium of the parent fungus. The cytoplasm of the oogonia becomes rounded up and gets differentiated into an uninucleate egg, a peripheral periplasm containing the supernumerary nucleii. The antheridia also undergoes corresponding changes. The male nucleus gets differentiated and a fertilisation tube is also put forth and the male gamete passes to the oogonium where all the other nucleii except the egg nucleus have disintegrated. The male gamete fuses with the egg nucleus after which a thick wall is formed around the zygote. Reduction division follows and the oospores so formed fall to the ground and infect a subsequent host by the formation of a germ tube and through this the spore gets into the leaf.

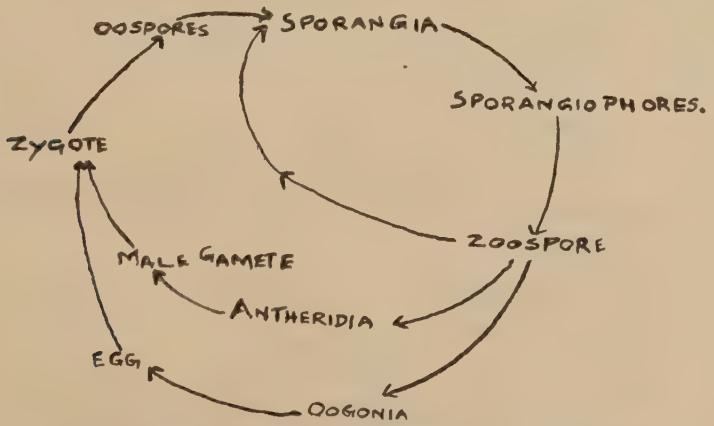

FIG. 1. Infection Cycle of *Sclerospora graminicola.*

Control.—In cases where it is practicable, it is best that the field crops that get infected in a particular area might be eradicated. But in cases where the disease is spread over several acres it is not possible to destroy the whole crops as it is. The earliest types of fungi-

cides were quite effective in the control of the disease, namely, two volatile compounds, Benzol and Paradichlorobenzene.

Another very common disease in India is the sorghum rust caused by a species of the fungi, *Puccinia*. People are of varied opinion as to the exact species that cause the disease. Some say that it is due to *P. purpuræ* and some others attribute it to *P. sorghii*. However, it is evident that the disease is caused by one of the above fungi and that it is one of the dreaded diseases in India.

Symptoms.—The earliest symptom that is observed in the case of this disease is by the formation of a red rust-like substance over the upper surface of the leaves. During clement weather it might also show to be black in colour. Within four or five days of the appearance of the rust there develops a pustule on the spot where the rust was. After sometime the epidermis of the leaf gets torn at the site of the pustule. As a result, the torn epidermis forms a border for the red spores known as uredospores inside the leaf.

Etiology.—The fungus develops by the propagation of two to three varieties of spores. The first-formed spore is the uredospore which develops on the lower side of the leaf. This after the infection produces spores, which, due to their increased numbers exert pressure and the epidermis gets torn. On the same mycelium, on the lower surface of the leaf, there develops another kind of spore, namely, the teleutospore. This also liberates the spores from inside. The teleuto-

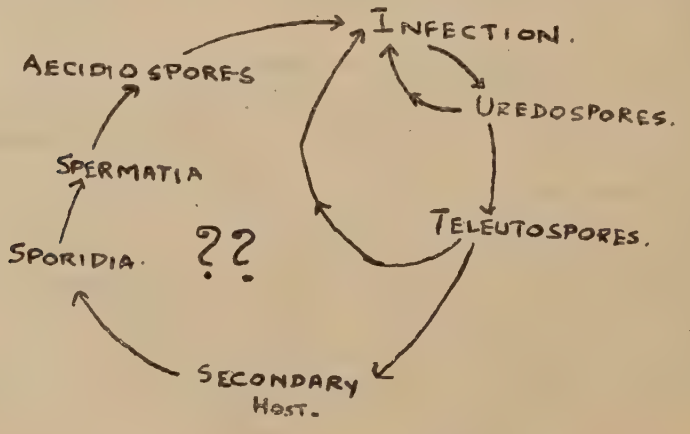

Fig. 2. Infection Cycle of *Puccinia sorghii*.

spores as they are, are capable of infecting a new host. But, usually in the other species of this particular fungi there is a secondary host, namely, the common Barberry plant (in the case of *P. graminis*), where the spore undergoes other changes and forms what is known as an aecium. From this aecium is developed spores known as the aecidi-

spores. These generate on the primary host later on by wind dispersal and start the cycle of infection again.

But in the case of the *P. sorghii* till now scientists were not able to establish the contact between a secondary host and the infection from there on. Might be, that there is no secondary host at all but the infection might be only from the uredo and the teleutospores.

Control.—This disease is a highly destructive one and there seems to be no other alternative than to remove first of all the secondary host, if there is any. Secondly, the pre-sowing treatment of the seeds is highly helpful. If resistant types of seeds are available it is best to use them. Also modification of the cultural habits helps a great deal in the control of the diseases.

In general the treatment of seeds helps a great deal in the prevention of the disease. The seed treatment in India usually consists of soaking the seeds for about ½ to 1 hr. in an 1% solution of copper sulphate. This is a very good measure. But, another procedure that is usually followed is to mix the seeds thoroughly with dry sulphur. This also underlies the same principle as above. In higher countries formaldehyde has also been used with the same efficacy. The latest methods are useful in the sense that they are very handy. Several commercial disinfectants have to be only mixed with the seeds, which is enough to kill the pathogenic elements present in the seed.

In case of fungus infections seed treatment may help a great deal, but in case the land and the crops get infected after the growth of plants, the only effective treatment is by spraying fungicides. They may be sprayed by the hand, or by spraying machines, or in cases of large infected areas by planes also. Whatever is the measure adopted, the goal is the same, that is to get good crops for use.

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METEOROLOGICAL OBSERVATIONS APPLIED TO AGRICULTURE

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ENVIRONMENT exercises a profound influence in determining man's economic and allied activities. Climate ultimately determines the type of cultivation. Man cannot materially alter his climatic environment, but he can considerably modify its effects and turn to his own advantage by introducing many artificial means.

The facts and data accumulated in the study of weather and climate are capable of infinite application to agriculture. They are used directly and daily by the farmer. The growth of plants in a great degree is a response to atmospheric influence, to which the plants have been subjected. Although agricultural practices are mainly determined by long experience, the knowledge gained by meteorological observations aids in adjustment of farm operations to the most favourable weather conditions. The meteorological data collected are indispensable in the calculation of correlation between weather and crop yields. The weather has to be regarded commercially in the same light as we regard the soil in agriculture.

The climate of a place is defined by a number of meteorological factors. The important elements to the observed are, temperature of the air, humidity, pressure of the air, direction and velocity of the wind, the amount of cloudiness, the amount of rainfall, duration of bright sunshine, thunderstorms, high winds, floods, hail storm, frosts, etc.

The temperature and precipitation play an important role in crop production. The temperature requirement of a plant cannot be supplied artificially on a large scale. Temperature is considered as a main clussifactory value and its measurement and statement is a matter requiring special attention. The cultivation of wheat, rice and other crops are limited by temperature and precipitation. The wheat crop requires moderate temperature ranging from 40 to 60° F. It is a typical product of temperate zone. It requires cool moist climate in early stages and warm, dry and bright summer condition during harvest, whereas rice is a typical crop of tropical and subtropical regions which requires high temperature ranging from 60° F. to 80° F. and heavy rainfall. Different species of plants have different temperature requirements. The precise weather observation should be made before introducing new crops. During ripening stage, the lint of

cotton is mostly influenced by relative humidity of atmosphere. That is the reason why cultivation of good quality cotton is limited to small areas.

The relationship between the weather conditions of a place and kinds of crops cultivated is obvious. The first step in the development of agricultural meteorology is to observe, measure and record meteorological factors as they occur. The weather is very uncertain during the months of June and July. And it is in these two months most of the crops are sown. Sowing requires favourable weather. Even a forecast of 8 or 10 hours ahead is of great use for the farmer.

At harvest times, when the crops are fit to cut, the cultivator must decide by means of local observations and in the daily papers whether the weather is or likely to be of a settled or unsettled nature, during the course of the following day or two.

The science meteorology is undergoing a rapid development. The collection of up-to-date information with regard to the weather and life-history of cultivated crops is a matter requiring serious attention.

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